

Having thus described the preferred embodiments, the invention is now claimed to be:

1. A method for classification of an image, comprising the following steps:

- a) extracting a plurality of features from an input image; and
- b) classifying the input image in picture or graphics classes using a combination of the extracted features, wherein the extracted features may be of the same or different type.

2. The method as set forth in claim 1, wherein the plurality of types of features include at least one of spatial gray-level dependence texture features, color discreteness features, or edge features.

3. A method for classification of an input image in natural picture or synthetic graphics classes, comprising the following steps:

- a) extracting one or more spatial gray-level dependence texture features from the input image;
- b) processing each extracted feature using an algorithm associated with the feature;
- c) comparing the result of each feature algorithm to one or more previously selected thresholds; and
- d) if, according to previously determined rules, any comparison is determinative of the class of the input image, classifying the input image in either the natural picture or synthetic graphics class according to the previously determined rules, otherwise indicating the result is indeterminate.

4. The method as set forth in claim 3, wherein step a) includes the following steps:

- e) processing the input image using a low-pass filter and initializing a spatial gray-level dependence matrix to zero, in any order;

f) building a spatial gray-level dependence matrix using the processed input image; and

g) extracting one or more features of the spatial gray-level dependence matrix.

5. The method as set forth in claim 4, wherein steps a) – g) are performed in conjunction with at least one of a variance feature, a bias feature, a skewness feature, or a fitness feature of the spatial gray-level dependence matrix.

6. A method for classification of an input image in natural picture or synthetic graphics classes, comprising the following steps:

a) extracting one or more color discreteness features from the input image;

b) processing each extracted feature using an algorithm associated with the feature;

c) comparing the result of each feature algorithm to one or more previously selected thresholds; and

d) if, according to previously determined rules, any comparison is determinative of the class of the input image, classifying the input image in either the natural picture or synthetic graphics classes according to the previously determined rules, otherwise indicating the result is indeterminate.

7. The method as set forth in claim 6, wherein step a) includes the following steps:

e) transforming the input image to a color space;

f) processing the input image using a low-pass filter; and

g) extracting one or more color discreteness features from the transformed image.

8. The method as set forth in claim 7, wherein the color space is a CIELUV color space.

9. The method as set forth in claim 8, wherein steps a) – g) are performed in conjunction with an R_L color discreteness feature and wherein step g) includes the following steps:

h) computing a histogram for the luminance color channel (L) of the transformed image; and

i) normalizing the histogram for the luminance color channel (R_L) based on the number of pixels in the input image to extract the R_L color discreteness feature.

10. The method as set forth in claim 8, wherein steps a) – g) are performed in conjunction with an R_U color discreteness feature and wherein step g) includes the following steps:

h) computing a histogram for the U color channel (U) of the transformed image; and

i) normalizing the histogram for the U color channel (R_U) based on the number of pixels in the input image to extract the R_U color discreteness feature.

11. The method as set forth in claim 8, wherein steps a) – g) are performed in conjunction with an R_V color discreteness feature and wherein step g) includes the following steps:

h) computing a histogram for the V color channel (V) of the transformed image; and

i) normalizing the histogram for the luminance color channel (R_V) based on the number of pixels in the input image to extract the R_V color discreteness feature.

12. A method for classification of an input image in a synthetic graphics class, comprising the following steps:

a) extracting one or more edge features from the input image;

b) processing each extracted feature using an algorithm associated with the feature;

c) comparing the result of each feature algorithm to one or more previously selected thresholds; and

d) if, according to previously determined rules, any comparison is determinative of the class of the input image, classifying the input image in either the natural picture or synthetic graphics classes according to the previously determined rules, otherwise indicating the result is indeterminate.

13. The method as set forth in claim 12, wherein step a) includes the following steps:

- e) processing the input image to detect edges;
- f) creating an edge map image showing the detected edges;
- g) processing the edge map image to connect the detected edges; and
- h) extracting one or more edge features from the edge map image.

14. The method as set forth in claim 13, wherein steps a) – h) are performed in conjunction with an edge feature based on at least one of, an average number of pixels per connected edge a quantity of horizontal edges or a quantity of vertical edges.

15. A method for classification of an input image in natural picture or synthetic graphics classes, comprising the following steps:

- a) extracting a plurality of features from an input image;
- b) scaling two or more extracted features to binary values; and
- c) processing the two or more scaled features using a neural network to classify the input image in either natural picture or synthetic graphics classes.

16. The method as set forth in claim 15, wherein the plurality of features extracted in step a) include one or more spatial gray-level dependence texture features.

17. The method as set forth in claim 16, wherein the spatial gray-level dependence texture features are based on features extracted from a spatial gray-

level dependence matrix representing the input image and wherein said features include one or more of a set comprising a variance feature, a bias feature, a skewness feature, and a fitness feature.

18. The method as set forth in claim 15, wherein the plurality of features extracted in step a) include one or more color discreteness features.

19. The method as set forth in claim 18, wherein the color discreteness features are based on features extracted from color histograms computed from a representation of the input image in a color space and wherein said features include one or more of a set of multiple normalized histograms.

20. The method as set forth in claim 18, wherein the color discreteness features are based on features extracted from color histograms computed from a representation of the input image in CIELUV color space and wherein said features include one or more of a set comprising a normalized histogram for the luminance color channel (R_L), a normalized histogram for the U color channel (R_U), and a normalized histogram for the V color channel (R_V).

21. The method as set forth in claim 16, wherein the plurality of features extracted in step a) include one or more edge features.

22. The method as set forth in claim 21, wherein the edge features are based on features extracted from an edge map image representing the input image and wherein said features include one or more of a set of features comprising an average number of pixels per connected edge, a quantity of horizontal edges, and a quantity of vertical edges.

23. The method as set forth in claim 16, wherein the neural network of step c) is constructed in a feedforward architecture comprising an input layer, at least one hidden layer, and an output layer and includes a back-propagation algorithm.

24. The method as set forth in claim 23, wherein the input layer of the neural network is comprised of two or more source nodes corresponding to the two or more extracted features.

25. The method as set forth in claim 23, wherein the output layer of the neural network is comprised of one neuron for indicating the result of processing by the neural network and the corresponding classification of the input image between natural picture or synthetic graphics classes.

26. The method as set forth in claim 15 further including the following steps between steps a) and b):

d) processing at least one of the extracted features using an algorithm associated with the feature;

e) comparing the result of the feature algorithm to one or more previously selected thresholds; and

f) if, according to previously determined rules, the comparison is determinative of the class of the input image, classifying the input image in either the natural picture or synthetic graphics class according to the previously determined rules, otherwise continuing to step b).

27. The method as set forth in claim 15, wherein an edge feature based on an average number of pixels per connected edge in an edge map image of the input image is extracted in step a), and the following steps are performed between step a) and step b):

g) processing the edge feature based on the average number of pixels per connected edge using an algorithm associated with the feature;

h) comparing the result of the feature algorithm to a previously selected high threshold; and

i) if the result of the feature algorithm is above the high threshold, classifying the input image in the synthetic graphics class, otherwise continuing to step b).

28. The method as set forth in claim 15, wherein a color discreteness feature based on a normalized histogram of the luminance color channel (R_L) for a representation of the input image in the CIELUV color space is extracted in step a), and the following steps are performed between step a) and step b);

g) processing the color discreteness feature based on the normalized histogram of the luminance color channel (R_L) using an algorithm associated with the feature;

h) comparing the result of the feature algorithm to previously selected high and low thresholds; and

i) if the result of the feature algorithm is either above the high threshold or below the low threshold, classifying the input image in either the natural picture or synthetic graphics classes according to previously determined rules, otherwise continuing to step b).

29. A image processing system for producing an output image associated with an input image based on classification of the input image, comprising:

a feature extractor for extracting a plurality of features from the input image;

a binary classifier for classifying the input image in natural picture or synthetics graphics classes using a combination of any two or more of the extracted features;

a picture processing module for processing the input image using picture image processing functions;

a graphics processing module for processing the input image using graphics image processing functions; and

a switch for routing the input image for image processing by the picture processing module or the graphics processing module based on the classification of the input image by the binary classifier in either natural picture and synthetic graphics classes.

30. The image processing system as set forth in claim 29, wherein the feature extractor extracts a plurality of spatial gray-level dependence texture

features, color discreteness features, and/or edge features and the binary classifier uses any combination of two or more of said features to classify the input image.

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